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EPIDEMIC
CEREBRO-SPINAL MENINGITIS,

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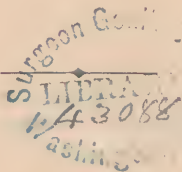
MOREAU MORRIS, M. D.,

Formerly

CITY SANITARY INSPECTOR

OF

HEALTH DEPARTMENT.



New York :

TOWER, GILDERSLEEVE & CO., PRINTERS.

76 AND 78 CHAMBERS STREET,

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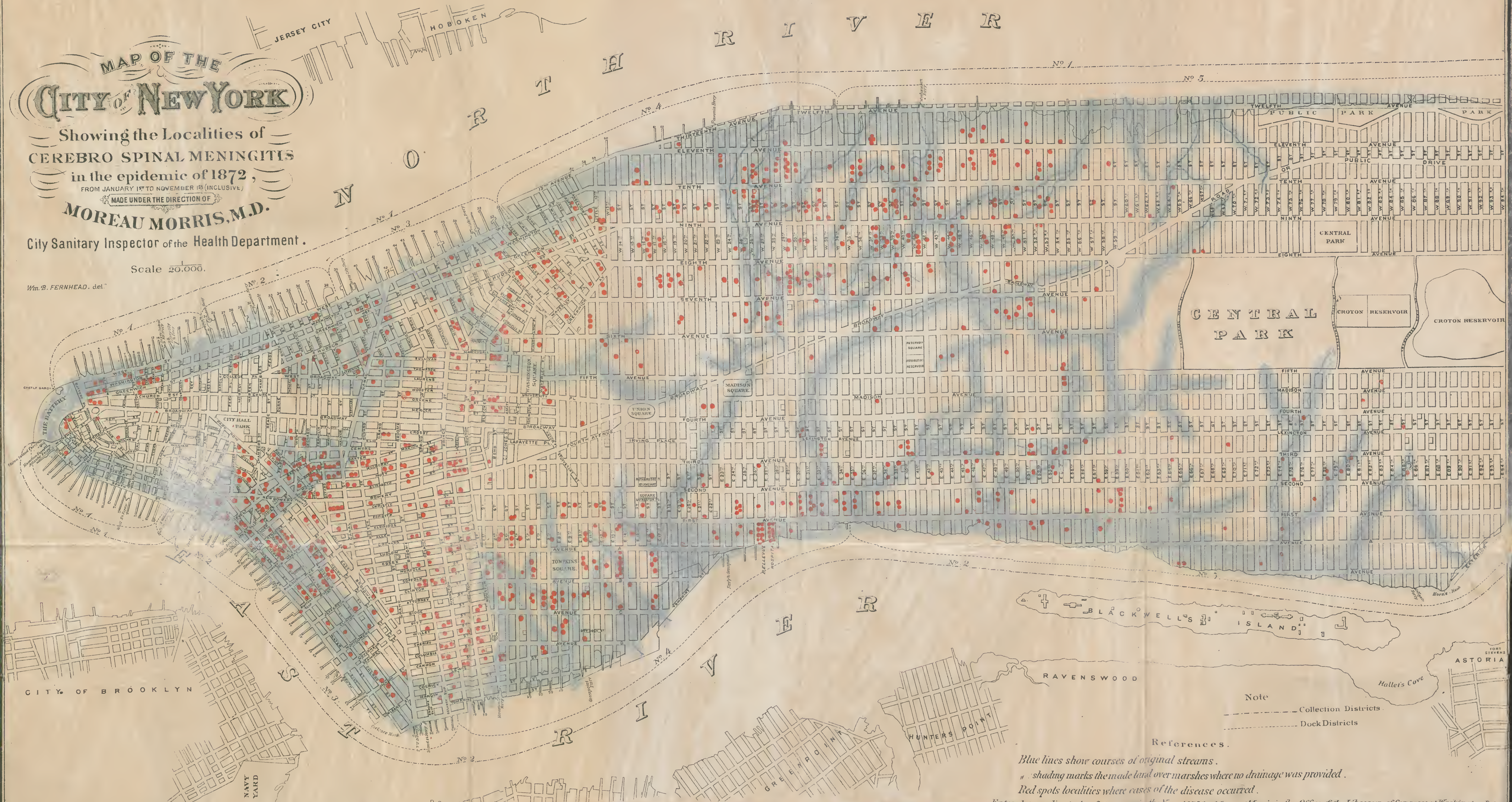
1873

film no. 2212, no. 2

MAP OF THE
CITY OF NEW YORK
 Showing the Localities of
CEREBRO SPINAL MENINGITIS
 in the epidemic of 1872,
 FROM JANUARY 1ST TO NOVEMBER 1ST (INCLUSIVE)
 MADE UNDER THE DIRECTION OF
MOREAU MORRIS, M.D.
 City Sanitary Inspector of the Health Department.

Scale 20,000.

Wm. B. FERNHEAD, del.



Note
 - - - Collection Districts
 - - - Dock Districts

References.

Blue lines show courses of original streams.
 " shading marks the made land over marshes where no drainage was provided.
 Red spots localities where cases of the disease occurred.

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EPIDEMIC CEREBRO-SPINAL MENINGITIS.

By MOREAU MORRIS, M. D.,

CITY SANITARY INSPECTOR, NEW YORK.

The following report upon this disease, is the result of investigations and records in the Bureau of Sanitary Inspection of the Health Department, which were made by its officers, during the recent epidemic which, as an epidemic, appeared for the first time in the city of New York, at the beginning of the year (1872). Isolated cases had occurred during previous years, as the records of the Bureau of Vital Statistics of this department show. Deaths had been recorded from "Cerebro-Spinal Meningitis:" in 1866, 18; in 1867, 32; in 1868, 34; in 1869, 42; in 1870, 32; 1871, 48. The statistics of the disease, as recorded herein, do not give all the cases that occurred within the periods mentioned, as some physicians failed to recognize it, from want of personal familiarity with the affection, during the beginning of the epidemic; and some neglected wholly to comply with the law, in respect to reporting their cases to this Bureau. It may be approximately estimated, that probably about one hundred cases, which eventually recovered, were thus not recorded in the Bureau; which estimate should enter into the percentage of deaths to all cases.

During the early part of January, 1872, reports of a "new form of disease" began to reach the Bureau of Sanitary Inspection. Some called it "Spotted Fever," others "Epidemic Meningitis, a fever resembling Typhoid, and Typhoid complicated with Acute Meningitis."

Preceding this outbreak, the officers of the Bureau of Sanitary Inspection had been anxiously anticipating the appearance of some form of Zymotic disease in consequence of the excessive quantities of filth, which had accumulated throughout the city, by the neglect of the street cleaning department. Probably never, in its municipal history, had such a disgraceful condition existed so long. Again, the preceding nine months had been attended with most unusual atmospheric conditions.

There had been a continuance of high temperature, with long absence of rain. As a consequence, the vast system of defective sewerage, underlying our streets and dwellings, had become surcharged with an enormous quantity of sewer gas, evolved during the decomposition of animal and vegetable matters therein. There had been no sufficient rain-fall to flush and wash out these accumulations, and consequently the public sewers had become vast receptacles and storehouses for this product of chemical and organic decomposition.

Knowing well the defects in the public sewerage system, as regards faulty grades and bad construction, and the bad, even criminal, manner in which private drains and sewers are almost universally built, as regards their inefficiency and insufficiency for the purposes intended, viz.: that of rapidly carrying away all effete matter put into them, by water flushing, and of preventing the escape of noxious gases into dwellings, by means of air-tight joints and traps, the sanitary officers of this Bureau at once suspected that local conditions would be found, such as would throw light upon the hitherto obscure etiology of this and kindred forms of disease.

With the first well-marked group of cases that occurred late in January, special investigations were instituted, to ascertain, if possible, what might be the cause. The conditions of defective local drainage were found to be such as would necessarily produce disease.

Pursuing this line of inquiry with succeeding cases as they were reported, it was discovered that, almost universally much the same unsanitary conditions varying in degree, appertained to each case. It is hardly possible to convince one unskilled in this kind of examination, of the true danger that lurks in a defective sewer, whose open joints or insufficient water-traps, or open communication with the main street sewer, furnishes a direct outlet or vent through which poisonous sewage gases escape into dwellings.

The effects of inhaling and absorbing into the human system these products of putrefactive decomposition are too well known by practical sanitarians to require any extended argument regarding cause and effect. As the receptivity or susceptibility of persons differ widely, so one may be poisoned by a peculiar principle developed by decomposition, while another may escape entirely any bad consequence; and as the various powers of resistance make it safe for one, so may the absence of those powers render it very dangerous to others.

Again, the peculiar special poison may not always be eliminated to the same degree in all places and under all circumstances, and thus

perhaps the special cause of this peculiar form of disease may not always be sufficiently developed, or of such pungency, as to produce its special effects.

The human economy is so peculiarly constructed that subtle poisons of a gaseous nature, or perhaps possessing organic forms too minute as yet to be discoverable by art, enter it, either by inhalation or absorption, through the medium of the lungs or skin. Being absorbed into the circulatory system, they are thoroughly intermixed, and their effects are produced, varying in form and degree with the individual peculiarities and according to their own specific laws, which are not yet well understood.

The general histology of this special disease has been so frequently recorded in medical literature that a simple reference to the authorities will here suffice. The following extract is taken from Dr. Meredith Clymer's work on Cerebro-Spinal Meningitis, 1872. Its diagnostic symptoms are now well recognized, and will be only briefly stated.

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Netten Radcliffe: Reynold's System of Medicine, vol. ii; London, 1868. Edward W. Collins, M. D.: A Report on Epidemic Cerebro-Spinal Fever; Dublin Quarterly Journal of Medical Science, August, 1868.

The Medical Journals of this country, published during 1864, '65, '66, and those of Dublin and London, during 1866-'67, contain valuable articles, but too numerous to mention separately here."

This disease generally appears as an epidemic varying in degree and intensity, having acute specific characters; its onset is sudden; its course rapid and very fatal.

Its symptoms may be classified into local and constitutional. The local (acute), specially manifested in the cerebro-spinal axis; the general or constitutional, through the poisoned blood acting upon the whole nervous and circulatory system.

The special symptoms uniformly presented in the large number of cases herein reported, establish its definite and epidemic character. Although every case did not present the same formula of symptoms, yet those that were manifested left no room for doubt as to the diagnosis. Some presented one class of symptoms more predominant than another, and seemingly varying in degree and intensity in proportion either to the exposure to the exciting cause, or perhaps the individual idiosyncrasy, or the duration of the attack.

As a rule, the attack seemed sudden, with scarcely any or no premonition. Sometimes, however, there was described a feeling of weariness or *malaise* of a few hours' duration; but from the fact that a large proportion of the cases occurred among young children, this precursory manifestation could not be relied upon. Usually the first marked disturbance complained of was a sense of chilliness—rarely any decided chill—accompanied with severe headache, acute in character, generally described as excruciating, sharp, and almost intolerable, sometimes extending through the nape of the neck, and also affecting the limbs and joints, particularly the joints, resembling acute rheumatism. These painful conditions are universally attended with an extreme feeling of prostration and great debility. In young children vomiting is frequently the first symptom noticeable. Gradual stiffness with sometimes spasmodic action of the cervical and spinal muscles supervenes; occasionally delirium, varying from muttering hallucinations to acute mania, with soporific intervals and coma; or intervals of a complete return of intelligence, succeeded by an aggravation of the acute symptoms.

The convulsive condition may be trismus, tetanus, tonic and clonic spasms, and even complete opisthotonos has not unfrequently been seen. The cephalic symptoms usually appear to have periods of exacerbation in the after part of the day. Sometimes there is double or distorted vision, tinnitus aurium, and complete deafness has occurred, while dull-

ness of hearing is a constant symptom. The sense of taste is impaired, with entire indifference to food, and very little, if any, thirst.

The pulse is quick and feeble; the tongue slightly coated with a whitish fur; the skin usually cool and moist; the face suffused; conjunctiva somewhat congested. The intelligence may continue throughout the disease unimpaired. Eruption usually appears early in the disease, during the first two days, resembling roseola, measles or a diffused rash, like that in Typhus and sometimes pectechiæ, vibices or ecchymosis. Dark mottled spots occasionally are seen scattered over the surface of the body. The eruption is hæmic and is usually seen upon the face, neck, abdomen, back, arms and legs. It is not constant and in some cases may not be discovered at all. In some, no change of skin is observable until after death, when the whole surface has been seen of a rosy, mottled hue, lasting for some hours, especially when the disease has been rapidly fatal. Herpes of the lips extending to other parts of the face, ears and neck, were occasionally observed. Cutaneous hyperæsthesia, local or general, was frequently presented. The expression of the face is peculiar and presents a striking indication of the gravity of the disease; usually pale, sunken and distressed; frequently distorted by the paroxysms of pain; listless, indifferent to surrounding objects, except noise and light. The pupils vary; in some, contracted; in others, dilated and irregular.

Purulent ophthalmia; softening and ulceration of the cornea; choroïditis and opacity of vitreous humor not unfrequently are subsequent symptoms or affections. The temperature does not present that uniform high degree usually attending diseases of a febrile character, but varies remarkably and in conformity to the variations of the pulse, being remarked in some cases as below the natural standard. Its usual variations have been recorded as between 100° and 105°. The fatality of this disease is very great, as will be seen that out of 990 cases reported to this Bureau, 747 were fatal.

Various predisposing and exciting causes have been given by different writers as to the etiology of the disease. Although nothing constant has been noted by these which might be attributed as being the special cause, yet most agree that unsanitary conditions have probably furnished the factors. Although the special cause has not heretofore been satisfactorily demonstrated, the investigations during the present epidemic point strongly, if not convincingly, to the gaseous emanations of animal and vegetable decomposition, as presented in the defective sewerage system of this city, and entering into the dwellings con-

nected therewith ; in the large accumulations of the same putrefactive processes going on in our public streets ; in the overcrowded condition of our tenement population, wherein exhalations of a similar kind are being constantly generated ; and in the water-saturated soil of the undrained portions of the city, where former living streams had been obstructed in their courses ; or land has been made from the debris of the city over its marshy marginal portions. A reference to the map accompanying this report must convince the most skeptical that these conditions have been the chief source in the production of the specific factors of this disease as it occurred in this city.

During the first three or four months of its continuance, the markings of the localities of the disease as exhibited upon the accompanying map *were almost entirely confined to those portions represented by the blue line* (original water courses), *and the blue shading* (water, saturated soil, filled in, along the margins of the city). Subsequently the disease developed itself principally throughout the densely populated sections of the city, where overcrowding, defective ventilation, and bad house-draining was the rule. Even in those isolated cases, where neither of these conditions seemed to be very evident, upon a careful examination of the house-drainage, defects were discovered almost in every instance, furnishing additional proofs that this special poison had been developed from this source. So uniformly were these defective conditions of the house-drainage found, when carefully sought for by an expert, that the conviction forces itself upon the observing mind, that the source of this malady must be sought for in the products of animal and vegetable *decomposition*, as it occurs in sewage ; or under other circumstances, in connection with certain atmospheric conditions. These remarks are not intended to assert beyond cavil that this is the only source of this malady, but to the unprejudiced mind, the illustration afforded by the accompanying map, in connection with the history of the progress of this disease, as it occurred in this city, from its commencement, as showing its habitats, its correlative circumstances, and the absence of any other known cause, certainly affords strong presumptive evidence that these conditions cannot be ignored in the study of its etiology.

It has been said, "Why then does this disease occur in rural districts, upon upland as well as upon lowland, among the rich as well as the poor, the well-fed as well as the ill-fed, among those who have enjoyed thorough ventilation, as well as those confined in close quarters, among the civil as well as the military population?" From these very

facts, does it not appear that there must be some special condition, or poison eliminated, which is developed under all these varying circumstances and conditions; and of which, under certain peculiarities, either of constitution or physical condition, some of those exposed fall victims; while others escape, although exposed to the same exciting cause? Do all have Typhoid, or Typhus, or Scarlet Fever that may be exposed to either? And may not the same person escape at one time, and be attacked at another. As the laws of health and sanitary science, or the prevention of disease by the application of that science, become better known, perhaps these causes may be more definitely pointed out. Already the professional, as well as the non-professional mind has become convinced of the fact that in sewage and its *decomposition* lurks a gaseous poison, whose direct effect upon the human system is Typhoidal. How many centuries have elapsed to bring this conviction? It may take as many more to convince doubting minds of the truth of the present observations.

Animal and vegetable decomposition is going on in all seasons, and all places. The chemical laboratory of nature never ceases in its operations; gaseous eliminations whether vitalizing, or poisonous and destroying, are ever in operation; man, through ignorance, or indifference, exposes himself to all, and the result is disease in one form or another. These gases are not fully understood by the chemist, and their effects under all circumstances are yet a study. That under favoring conditions they will or do produce epidemics, or local diseases of a kindred nature, cannot be doubted. Certain combinations may produce one form or another of disease, and we may not be able to fathom or grasp all the correlations of circumstances which at one time produce one form of disease, and at another time other forms.

One fact, it may be well to mention. It is the almost universal rule in country habitations, to store vegetables in the cellars, and to neglect the proper drainage of the houses. Vegetable decomposition (rotting) begins to take place early. No escape is usually provided, by any proper system of ventilation, for the gases that may be generated in the cellars to prevent the effects of frost; as they are generally well inclosed, consequently these emanations have no other outlet but into the rooms over them, where usually the family dwells and often sleep. Again it may be remarked, that this disease is almost always first developed during the winter months, which is the usual period for vegetable decomposition to commence, when scarcely any fresh air or sunlight—the great natural sanitary prophylaxes—ever enters these confined places.

Meteorology affords additional evidence—as under certain atmospheric conditions—that this poison is eliminated during the putrefactive decomposition of animal and vegetable matter, which may be either upon the surface of the earth, confined in sewers, drains or cellars, or in crowded, filthy habitations.

During the continued heat of summer the earth's surface becomes heated to the medium depth of four feet, depending upon the nature of the soil. The annual fluctuation of temperature beneath the earth's surface depending upon the conductivity of the soil, undoubtedly greatly influences health, during periods of drouth, when moisture does not assist in the radiation of heat from the surface of the earth.* Prof. Forbes states that “the temperature of the ground increases by induction and conduction of solar heat to a very considerable depth; and by actual experiment he found that the neutralization point of temperature, by absorption of solar heat and its radiation outward as terrestrial heat, is found at a depth of 57 to 99 feet.”

As solar heat thus absorbed into the earth passes upward by conduction, and is radiated from its surface, so is brought with it whatever gases of decomposition may be present. These, under the ordinary fluctuations of temperature and hygrometric conditions of atmosphere, become absorbed and condensed in the form of vapor, and are thus held innocuous; while under other conditions of prolonged dryness of atmosphere, as in drouth, escaping as gases undiluted, are highly deleterious to health, and may become direct poisons upon the human economy. As an illustration of the difference in health, probably owing to these terrestrial and atmospheric causes, we may compare the general health or diseases of those who spend the majority of their lives upon the ocean, with those dwelling upon the land. Upon the ocean, solar heat is rapidly dissipated, and no like organic decomposition of vegetable and animal matter takes place, as does in and upon the land.

In this connection, with reference to the present epidemic, an investigation of the meteorological conditions immediately preceding its outbreak, exhibits the fact that, during the last three months of 1871, and the first three months of 1872, there had been comparatively with the corresponding six months of ten previous years, a very unusual and marked dryness of the atmosphere; and when we remember that this disease began to develop coincident with the lowest point of humidity.

* It is a well-established fact that in rural districts, after a long drouth, Typhoid Fevers become very prevalent. Wells and springs become impregnated with poisonous matters, filtered through the surrounding earth, and the water is drank unwittingly, and thus produces disease.

and rapidly increased during that dry state of the atmosphere, we may, perhaps, recognize an element having a most important bearing upon the question.

The following tabular statement exhibits the comparative rain-fall for these months, with that of the same months for the ten preceding years, with the difference:

	Whole rain-fall.	Average for 10 years same month.	Difference.
October, 1871.....	7.72 inches.	7.72 inches.
November, 1871.....	4.59 “	4.79 “	— .20 inches.
December, 1871.....	2.05 “	2.29 “	— .24 “
January, 1872.....	1.92 “	2.70 “	—1.18 “
February, 1872....	2.14 “	2.04 “	× .10 “
March, 1872.....	2.75 “	2.12 “	× .63 “

This exhibits a total rain-fall for the six months of 21.17 in., while the total for the previous six months of the year 1871 was 31.60 in., a falling off of 10.43 in. And during the progress of this disease in this city, from January to November inclusive, following the low points of humidity, it is found that the disease increases, and on the contrary, when the humidity increased, the disease rapidly diminished; and so apparent was this fact, that the remark was hazarded, ‘that when we had a sufficient rain-fall to thoroughly flush and wash out our sewers, and at the same time increase the density of the atmosphere, the disease would rapidly subside;’ which eventually proved a fact.

The difficulty of ascertaining the hygrometric conditions of the atmosphere in other localities where the disease has heretofore prevailed, prevents any comparison with reference to them, but probably the same fact was true of them.

The large predominance of the cases as they occurred in the earlier months in this city, being located over water-saturated soil, is very striking, and forcibly illustrates the idea of atmospheric combinations in the development of this special poison; in that the evaporation of the deep sub-soil moisture brought with it some elements or factors laden with the special poison of this disease.

The statistics of the disease as it prevailed in this city, and as reported to the Health Department, from January 1st, 1872, to November 1st, 1872, are here presented in a Tabular form:

Total number of cases reported.....	990
“ “ deaths reported.....	761
“ “ houses in which cases occurred.....	835
Number of houses in which 1 case occurred.....	741
“ “ “ 2 “ “	68
“ “ “ 3 “ “	18
“ “ “ 4 “ “	1
“ “ “ 5 “ “	2

NUMBER OF CASES REPORTED FROM HOSPITALS INCLUDED IN THE TOTAL ABOVE.

Charity Hospital.....	20	Bellevue Hospital.....	18
Colored Home.....		St. Luke's Hospital.....	4
German Hospital.....	3	Infants' Hospital.....	2
St. Francis' Hospital.....	2	Blackwell's Island.....	2
Mount Sinai Hospital.....	1	Roosevelt Hospital.....	1
St. Vincent Hospital.....	1	St. Mary's Hospital.....	1
Strangers' Hospital.....	1		

STREETS IN WHICH THE LARGEST NUMBER OF CASES OCCURRED.

Third Ave.....	25	Delancy St.....	10
First Ave.....	21	Madison St.	10
Mulberry St.....	18	West 26th St.....	10
Ninth Ave.....	18	Chrystie St.....	9
Tenth Ave.....	18	West 23d St.....	9
Cherry St.....	16	West 38th St.....	9
Eleventh Ave	17	Elizabeth St.....	8
Mott St	16	Monroe St.....	8
West 29th St.....	13	Seventh Ave.....	8
Baxter St.	12	West 19th St.....	8
Greenwich St.....	12	West 30th St.....	8
Second Ave.....	11	West 44th St.....	8
Washington St.....	11	Willelt St.....	8

By these statistics it appears that by far the largest proportion of cases occurred singly in different houses; 741 houses having but one case in each, out of the whole number of 835 houses in which it occurred, and this fact also remarkably illustrates its non-contagious character. Indeed it must be conceded that so large a distribution of single cases, had this disease been one of contagion, must have added thousands to its numbers, and that, instead of confining itself to one susceptible victim, whole households would have been stricken with it.

The greater susceptibility and fatality in youth is also strikingly exhibited in the large number attacked under 15 years of age, as shown in the accompanying table.

TABULAR STATEMENT OF

**WHOLE NUMBER OF CASES OF CEREBRO-SPINAL
MENINGITIS**

REPORTED TO THE BUREAU OF SANITARY INSPECTION FROM JANUARY 1 TO NOVEMBER 1, 1872;
AND TOTAL NUMBER OF DEATHS, AS RECORDED IN THE BUREAU OF VITAL STATISTICS,
UNDER THEIR RESPECTIVE AGES AND SEX, FOR THE SAME PERIOD.

DEATHS.

	Under 1 Year.	Between 1 & 5 Years.	Between 5 & 10 Years.	Between 10 & 15 Years.	Between 15 & 20 Years.	Between 20 & 25 Years.	Between 25 & 30 Years.	Between 30 & 40 Years.	Over 40 Yrs.	Total.
Males	60	141	81	29	23	27	13	12	18	404
Females....	56	123	56	50	18	12	13	13	16	357
Total Deaths both Sexes	116	264	137	79	41	39	26	25	34	761

RECOVERIES.

	Under 1 Year.	Between 1 & 5 Years.	Between 5 & 10 Years.	Between 10 & 15 Years.	Between 15 & 20 Years.	Between 20 & 25 Years.	Between 25 & 30 Years.	Between 30 & 40 Years.	Over 40 Yrs.	Total.
Males	3	33	22	6	5	4	1	3	3	80
Females....	4	21	17	12	3	3	1	2	1	64
	7	54	39	18	8	7	2	5	4	144

RECOVERIES.

	Under 1 Year.	Between 1 & 5 Years.	Between 5 & 10 Years.	Between 10 & 15 Years.	Between 15 & 20 Years.	Between 20 & 25 Years.	Between 25 & 30 Years.	Between 30 & 40 Years.	Over 40 Yrs.	Total.
Ages given, but Sex un- known	2	18	28	9	5	3	2	1	2	70

Recovered—Ages and Sex unknown, 15.

Total Number of Cases, including Deaths, 990. Percentage of Deaths to Cases, 70.68.

During all these sanitary investigations, not one case occurred which presented any positive evidence of a personal contagious or infectious character; and indeed, the mass of recorded evidence by various writers in different parts of the world fails to prove that there is any specific contagion or infection from the person in this disease. Persons suffering with it during this epidemic, were removed to other and more healthy localities,

yet careful inquiries and investigation failed to show any case following such exposure.

Although several isolated cases had been officially reported to the Bureau early in the month of January, the first well-defined group was presented in the family of Mr. Brown, residing at 443 Eleventh, avenue, a medical history of which was kindly furnished by Dr. John G. Sewall. The abstracts of other cases, as they occurred from time to time subsequently, with a condensed description of their local surroundings, as reported upon by the Health Inspectors at the time, are here given as illustrations.

These cases and examinations afford a very striking corroboration that unsanitary and defective conditions of sewers and drain-pipes were the source from which this specific poison emanated.

Whenever families were removed to other localities, no new cases occurred; and when these faulty conditions of drainage had been remedied, or filthy accumulations had been removed, and the atmosphere thus purified, no new cases were developed upon the same premises. And, *vice versa*, when these unsanitary conditions were allowed to remain, other cases in the same family, or among other families dwelling upon the same premises, followed.

GROUP OF CASES FROM DR. SEWALL'S RECORDS.

I. "Albert Brown, residing at 443 Eleventh avenue, aged six years and six months, was, on the forenoon of January 30th, 1872, kicked in the side by a boy, and fell, striking his head against an iron railing. At 1 o'clock P. M. he reached home, but made little complaint of his injury until towards 7 o'clock that evening. He died on the morning of the 31st, at 4 o'clock. No physician saw him whilst ill, and there is, therefore, no account of the symptoms.

"A *post-mortem* examination by the Deputy Coroner, Dr. Beach, showed a thin layer of extravasated blood covering the surface of the brain, and extending to its base, with bloody serum in the ventricles. Dr. B. looked on the case as one of concussion of the brain, with rupture of a small vessel. There was a large patch of ecchymosis at the site of the kick, but no signs of peritonitis or other abdominal mischief. Some dark purpuric spots, irregularly scattered over the trunk, were noticed.

II. "Maximilian Brown aged four years, in good health during the day, and playing up to 4 o'clock, was, at 11 o'clock P. M., February 4th, 1872, seized with vomiting and general spasms, without loss of consciousness. He seemed in a fright, and called constantly after his lost brother—(Case I). He was seen at midnight by a physician. He died

February 5th, about 7 A. M. The medical attendant states that the brain symptoms were prominent; he did not look for any eruption. Meningitis was reported as the direct cause of death. No autopsy.

III. "Theresa Brown, aged thirteen years, was taken, February 6th, at 2 o'clock A. M., with pain in the head, moaning and crying out. She was seen by Dr. Sewall at 9 A. M. She had been sitting up during the night at her brother's "wake," and had been much affected by the sudden deaths of her two brothers. When first seen, intelligence was perfect, the pulse rapid, the skin of natural warmth and moisture. There had been some vomiting. She complained only of pain, not severe, over the whole head. Bromide of potash was ordered, with sinapisms to the feet and nape of the neck.

"February 7th. 10 o'clock A. M.—She was in much distress, complaining of her head, and her mind was wandering. The pupils were somewhat dilated. Intelligence good. There was much hyperæsthesia of the entire surface, with tenderness of the large joints, which she said was rheumatism, having once suffered from it. Pulse 120 in the minute, and of good volume. The tongue was covered with a thin white fur, but was not dry. She had not slept during the night; had vomited, and the bowels had been moved. At 4 P. M., she still complained of her head and limbs. The inhalation of chloroform had procured some sleep. A petechial eruption, not abundant, over the trunk and thighs. It varied in size from a pin's head to a canary-seed, did not disappear on pressure, and was of a deep purple hue. A diagnosis of "Spotted Fever" was made. Morphia, half a grain every second hour, beef-tea, and milk-punch were ordered. February 8th 9 A. M.—Pulse 120, and feeble; extremities cool; tongue and purpuric spots as before. Still complained of head, and of great sensitiveness of the skin. Much delirium and crying out, but the intelligence was good, and attention easily secured. Body heat 98° Fahr. Treatment continued. At 4 P. M., she was more composed; the purpuric spots were paler; face a little flushed; skin natural; pupils contracted readily to light; pulse 116, and with more volume; mind clear; tongue unchanged. February 9th, 10 A. M.—Passed an indifferent night, having been restless and delirious. Pulse 130 and feeble; skin warm; tongue whitish. For the first time since her illness says that she has no pain in the head or elsewhere. Petechiæ present; urine free; bowels open. Treatment continued.

"At 7 P. M. the pulse was 116 and fuller; no pains; had rather an uneasy day, though she slept at intervals. Takes milk and beef-tea moderately.

"Feb. 10th.—Had been restless and delirious all night, and again complains of pain in the head. Pulse 108, and of good character. Eruption less, and of a paler hue; tongue more coated, but not dry.

"Feb. 11th, 2 P. M.—Had slept soundly all night; pulse 86 to 88; eruption nearly gone; no pain in head or back, though a little in the limbs. Skin, rather cool, particularly of the extremities; tongue cleaner. Sitting up. Takes milk and broth freely.

"Feb. 12th.—Slept well; very irritable; pulse 96; a little pain in the head and back of the neck; eruption scarcely visible; tongue cleaning; lips parched and dry; skin rather warm; urine free, clear, with no change on the application of heat; bowels costive. Drinks milk-punch freely. Subsequently recovered.

IV. "Berthold Brown, aged eleven years. Was first seen on the morning of February 7th, about 10 o'clock, lying on a couch, moribund; with a cadaveric expression, and deep icterode hue. Pulse very rapid and scarcely perceptible; skin dry and hot; mind not clear, and he could hardly be roused; pupils contracted; complained chiefly of his head. He had been to his brother's funeral the previous afternoon, a distance of six or seven miles. He seemed well on his return home, and ate a hearty supper. Between 7 and 8 on the evening of the 6th of February, he sickened, with pain in the head, vomiting, purging, and chill. There had been no convulsions. He died at 2 P. M., Feb. 7th, eighteen hours after he was first attacked.

"Autopsy.—Feb. 8th, 11 o'clock A. M.—Rigor mortis strongly marked. An eruption similar to that in the girl (Case III), but in greater quantity on the body. The serous and mucous coats of the stomach showed purpuric spots similar to those on the body. It was also scattered, though less abundantly, over the peritoneal coat of both small and large intestines. Lungs, heart, liver, and kidneys were healthy. The blood was very fluid. The whole of the surface of the brain was intensely congested, the veins and sinuses being gorged with very fluid blood, though not entirely devoid of coagula. On section of the brain little points of blood netted out everywhere. The ventricles were nearly dry. Consistence of brain natural. No exudation or purulent matter found.

V. Feb. 10th.—"About midnight the baby, one year and three months old, was taken suddenly ill; she vomited, and had several loose stools. There were slight muscular spasms, but no decided convulsions; she died at 9 A. M. The body was covered with an abundant purple petechial eruption."

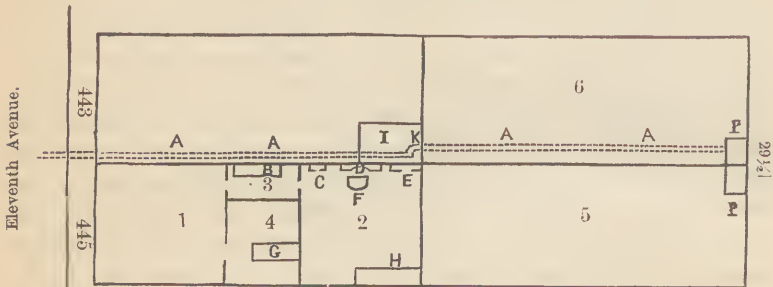
Description of Premises.—The family lived on the ground-floor of a house which was one of a row of wooden buildings, whose cellars had been made by filling up and grading the avenue in front, and of the yards in the rear. A good stone-wall foundation had been built underneath. The apartments occupied were: (1) (see diagram on page 16) a medium sized front room, used as a tin shop and store; (2) a rear room, used for the general purposes of the whole family; (3) a small passage-way leading from the front to the rear rooms, in which some of the children usually slept in a small crib, and (4) a bed-room between the rear room and the shop. In this bed-room, which had no other means of ventilation than the door, the father, mother, and some of the children slept. The whole family was thus chiefly confined to the rear room and the small unventilated bed-rooms on one floor, and on a level with the street and yard. In one corner of the rear room where the children spent the greater part of the day, was a closet [E] about one foot in depth, built against the partition wall of lath and plaster, separating this house from the adjoining one, with a base board not close to the flooring, not tight. There was nothing between it and the cellar, except the loose board floor. In this closet, which was chiefly used to hang up clothes, the children were in the habit of playing and spending much of their time. Immediately adjoining it was an unused fire-place, tightly closed by boards. Almost directly underneath the closet, but on the other side of the stone foundation partition wall, was the sewer pipe from a privy vault, common to the two dwellings. This sewer pipe of stone-ware led from the privy vault to and through the rear wall of the cellar, entering it about two feet above the bottom and connected with its extension, which passed underground to the street sewer, by an elbow (K) of the same stone-ware pipe. The two ends of this elbow were found to enter into the pipes above and below the joints, and had originally been luted with cement or common mortar, which, becoming disintegrated, had fallen out, so that there was no obstruction to the free escape of the sewer gases at either end of the elbow joint. This portion (I) of the cellar had been boarded up to the flooring above, to be used as a wood-bin, and was a moderately tight compartment, about six feet square, having within it the elbow of the sewer pipe.

Thus the escaping sewer gases were pretty effectually confined to that portion of the cellar, their chief means of escape being upward through the open partition wall and floor of the room above, through which they penetrated and diffused themselves, where the children usually played.

The mother stated that most offensive odors were constantly noticed, particularly in and about this closet. The oldest girl said to the Inspector, "Oh, sir, the smell is dreadful sometimes, making us sick, and almost vomiting. We had to open the doors and windows to get air. It smelt like rotten dead animals—it was awful!"

The following diagrams will illustrate the course of the sewer pipe through these premises, and the open-jointed elbow connection, situated immediately underneath the room and closet [E] where the children were in the habit of spending the most of their time.

FIRST FLOOR PLAN OF HOUSE 445 ELEVENTH AVENUE.

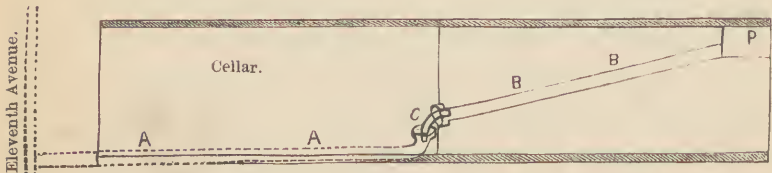


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|---|---|
| <ol style="list-style-type: none"> 1. Store in front. 2. Living room. 3. } Bed-rooms. 4. } 5. Yard of 445. 6. Yard of 443. A. A. A. A. (dotted line) shows the course of sewer connection from privy vault. B. Bed. | <ol style="list-style-type: none"> C. Closet. D. Fireplace. E. Closet, where children played. F. Stove. G. Bed. H. Lounge. I. Woodhouse, in cellar of No. 443. K. Elbow at joint between sewer pipes. P. P. Privy vault common to both houses. |
|---|---|

SIDE ELEVATION OF CELLAR AND YARD OF 443 ELEVENTH AVENUE.

First Floor.

Level of Yard.



- | | |
|---|--|
| <ol style="list-style-type: none"> A. A. House sewer connection. B. B. Sewer pipe from privy vault. | <ol style="list-style-type: none"> C. Elbow between the two pipes, with open joints. P. Privy vault. |
|---|--|

VI. 131 Lewis street, 4 deaths; two girls, aged respectively eighteen and twenty, and two children; they all slept in a room 10 by 15 feet; this room was connected by a ventilating window with an adjoining

one (6 by 8 feet), in which there was an untrapped sink ; there was no trap in the sewer pipe ; the general waste pipe of the house passed into a concrete pipe in the cellar, which connection was exposed by the removal of a large mass of decaying sawdust, when an opening was found in the concrete pipe having a superficies of about two square inches, from which so much foul air passed from the sewer as almost to blow out the flame of a candle.

VII. 538 Sixth street, 2 deaths ; a privy vault completely filled, and very offensive ; a drain leading from it to the sewer, which was open in a part of its course, allowing the foul gases to escape freely into the cellar. Immediately above this the two children who had died of the disorder had slept.

VIII. 39 East Broadway, 1 death* ; privy vault in yard, full ; cellar filthy ; sinks throughout the house untrapped, and foul odors escaping therefrom.

XI. 230 East Broadway, 1 death ; premises in bad condition ; yard, very filthy ; sinks untrapped, and foul odors escaping.

X. 23 Eldridge street, 1 case ; tenement house in bad sanitary condition ; defective sewerage and drainage.

XI. 24 James street, 1 death. The family lived in the basement of a large double tenement house, which basement was divided into a store in front, on the street ; a kitchen in the rear, and two sleeping-rooms (or passage-way closets) between. All the rooms were below the level of the street and yard. The inner sleeping-room, or closet, had no other ventilation or light than by the doors into both the store and kitchen. The other closet was lighted by two small glazed windows, which opened into an inter-space between No. 24 and No. 26, at the level of the ground, *i. e.*, five feet above the floor of the room, so that the air which came in when they were opened was very damp. The wall of this room, and of the whole side of the house was constantly wet, being directly against the earth. In this room, which the father described as always very foul at night, the child slept ; he said that the child lay with its mouth open, and seemed to be affected by the bad air. About six feet in rear of the eastern side of the rear room, or kitchen, there was a large privy vault common to the front and rear buildings, and from it, directly under the floor of the kitchen bed-room (in which

* It is not intended by these numbers to indicate that there was one death or one case only in that house. In many instances there were several ; but the abstracts are taken from the reports of the Inspectors, made immediately after a case or death from epidemic Cerebro-Spinal Meningitis was reported to the Bureau, to show the condition of the dwelling at the time of the outbreak of the disease in it.

the child slept), and store, passed the main sewer drain connection to the street. It was of brick, cemented on the outside; the moisture and gases of the sewer had penetrated and saturated the bricks and cement, and the exhalations which at times came from it "fairly steamed." The sewer was also broken and defective. Immediately over all this lived the family. At the bottom of the area steps, leading from the street down to the store, was a large iron grating, opening into a sort of excavation under the basement floor; through this came in full force the foul odors of the broken sewer; and hereabouts, directly in and around the doorway and steps, was the chief play-place of the infant.

XII. 284 Seventh street, 1 death; premises in bad condition; no traps; privy vault very offensive.

XIII. 204 Seventh street, 1 death; a female, who moved into the house on the 1st of May in perfect health, and about one week afterwards sickened with the disease. The sink*, untrapped and covered only with boards, projected into the bed-room, and the foul gases freely escaped into the room.

XIV. 47 Avenue B, 1 death; premises in bad condition; no traps under sinks in the house; privy vaults foul and offensive.

XV. 406 Broome street, 1 death; rooms filthy; sink in back room, untrapped, and emitting foul odors.

XVI. 219 Division street, 1 death; sinks untrapped; offensive odors constantly escaping therefrom.

XVII. 208 Elizabeth street, 1 death; rooms filthy; a hydrant sink untrapped, with sewer gases escaping.

XVIII. 153 Baxter street, 1 case; house cleanly, and well ventilated; a sink in the room connecting with the street sewer, untrapped.

XIX. 46 West Thirty-third street, 1 death; a brown-stone house in one of the best parts of the city. In the cellar the main waste pipe, connected with the sewer, had openings at the section-joints and at the connections of the smaller waste pipes from above; these fissures and openings had been hid and covered with a sort of soft cement, quite permeable, and useless for its purpose. Underneath the kitchen sink there had been such a leakage that the beams, together with the flooring over them, had rotted away, and emitted an odor like that from an old ice-box. This leakage had been only very recently repaired before the disease appeared in the house; all the sinks remained untrapped; the water-closet upstairs was without traps, and very offensive; in the ex-

* The word "sink" is intended to describe the kitchen slop-basin, where dishes are washed and the suds run off into the house drain by the pipe connection, or the usual wash-hand basins in other rooms.

tension room, on the parlor floor, there was a very peculiar and disagreeable odor, which was probably due to rotten or worn pipes in the wall or flooring.

XX. 63 Columbia street, 1 case ; premises in bad sanitary condition all the sinks (8) untrapped, the privy vault full and filthy.

XXI. 196 Second avenue, 1 death ; condition of the house (tenement), good ; but the cellar, contained large accumulations of rubbish and dirt, was very filthy and unventilated ; noxious gases escaped from this cellar, through a large hole in the floor, into the room immediately, under the bedstead on which the child who died of the disease slept.

XXII. 23½ Avenue B, 1 death ; privy vault very offensive ; sinks untrapped, and sewer gases escaped into the room in which the patient slept.

XXIII. 67 Cannon street, 1 death ; no traps at bottom of waste pipe connecting with sewer in cellar.

XXIV. 71 Cannon street, 1 death ; same as above ; no traps under kitchen sink in either house ; the tenants complained of bad odors in this house at times.

XXV. 219 Division street, 1 death ; no traps to sinks, and offensive odors escaping.

XXVI. 640 East Thirteenth street, 1 death ; no traps to sink ; privy vault full and offensive.

XXVII. 111 Mott street, 1 death ; no traps to sinks ; privy vault in front of room in yard.

XXVIII. 22 Avenue B, 1 death ; no traps to sinks ; privy vault full and offensive.

XXIX. 107 Clinton street, 1 death ; sinks trapped, but not sufficiently.

XXX. 406 Broome street, 1 death ; no traps to sinks in back room, and bad smell.

XXXI. 10 York street, 2 deaths ; also, 4 cases of Typhoid, 2 of which were fatal ; occupants Irish, German, Italian, and colored people, all extremely filthy ; house damp from cellar to roof, indescribably filthy and out of repair ; large privy vault, very full and offensive (common to 3 houses), near rear corner of house, and leakage from a hydrant was wetting and loosening the rear basement wall ; cellar and cellar hallway distressingly filthy with rubbish and garbage ; privy smells were " thick enough to cut with a knife ;" a hydrant basin, set loosely over the mouth of an untrapped (4 inch diameter) sewer pipe connection, contributed powerfully to the impurity of air in the close damp yard ; house subsequently vacated by order of the Board.

XXXII. 162 Second street, 1 death. "An open space, about two feet wide, in the rear of premises, was filled with garbage, rubbish, etc., and noxious gases from this place, as well as from the waste pipes of the sinks in the adjoining premises (No. 160), escaped into the bed-room of the deceased."

XXXIII. 106 Avenue C, 1 case; over a savings-bank. "Premises in good condition, but the state of adjoining yard (No. 333 Seventh street) was such, in my opinion, as to lead to the disease; the earth in the yard had been recently upturned in the removal of a privy vault; as the yard is inclosed on three sides by the walls of houses, and on the south by a high fence, the occupants must have breathed air contaminated by emanations from this privy vault, especially as the windows of the rooms of the bank open directly upon the yard, and were kept open day and night to allow the odors to escape from paint, turpentine, &c., which are present in new buildings."

XXXIV. 206 West Sixteenth street, 1 death. "Family live in a front basement, which is dirty and very damp; the sink in the hall often overflowing on account of obstruction in waste pipe; yard filthy, not paved; water runs from yard into rear area and rear entrance to hall."

XXXV. Northeast corner Twenty-third street and Eleventh avenue 1 death (sick ten weeks). "A new sewer is being constructed in Eleventh avenue, below Twenty-third street, and together with the stench from the gas-works and neighboring large horse-stables, the air at times is very offensive; at times, also, the stench comes up from the sewer through the waste pipes."

XXXVI. 560 West Twenty-sixth street, 1 death. "House, low basement dwelling; damp ground; filthy house and street."

XXXVII. 324 West Seventeenth street, 1 death; case on ground-floor; no basement; no sewer connection.

XXXVIII. 119 Baxter street, 1 death, "Six in family; apartments filthy; hydrant sink in room untrapped, and emits an offensive odor."

XXXIX. 105 West Forty-ninth street, the Assistant Engineer examined, and says: "Found sewer under basement door open, and a water-closet in front basement in bad condition."

XL. 441 West Twenty-sixth street. "Found eighteen slop-sinks connected to 2-inch iron pipes with badly constructed lead traps and connections; some of them had no "dip," or hollow, to hold water, and neither cement or anything in the connections to prevent the escape of foul odor."

XXI. Shanty on south side Sixty-seventh street, 300 feet west of Eighth avenue, 1 death. "Shanty is directly on brink of the exposed sewer which runs diagonally through this block and the next, to the north; the surface of the adjoining lot is perpetually covered with a deep layer of stagnant water and semi-solid sewage matter, and the effluvia is extremely detrimental to health."

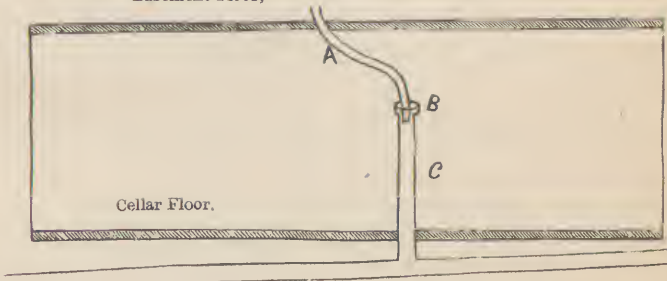
XLII. 176 East Sixtieth street, 1 death; private dwelling; several holes in sewer, in cellar.

XLIII. 196 Mottstreet; sewer in cellar broken; no traps to slop-sinks.

XLIV. 21 Morris street; privy vault and yard very filthy; no traps to slop-sinks.

XLV. 209 East Forty-eighth street, 1 death; child, aged 3 years; foul odors escaped into the house from an opening, occasioned by a $1\frac{1}{2}$ inch waste pipe, dropped in a 4-inch soil pipe, with no caulking or stopping of the space between the two.

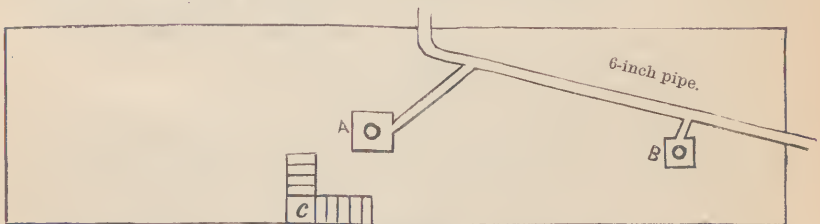
SIDE ELEVATION OF NO. 209 EAST FORTY-EIGHTH STREET.
Basement Floor,



A. $1\frac{1}{2}$ -inch lead pipe. B. Joint open. C. 4-inch iron pipe.

XLVI. 354 West Thirtieth street, 1 death; this house a brown-stone front; the fountains of noxious odors, in this case, were cesspools in the cellar, with large holes broken in the pipes connecting them with sewer.

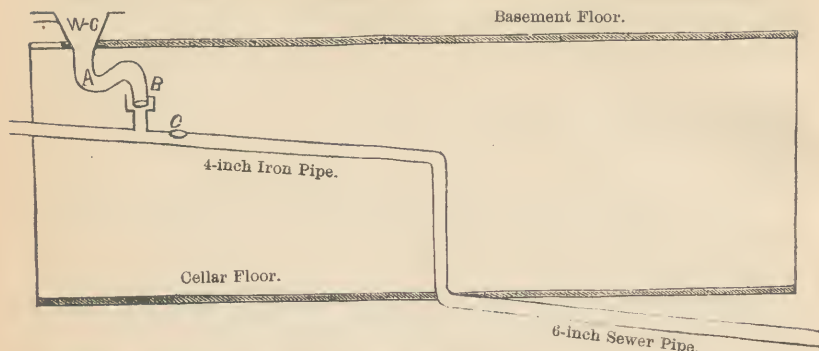
GROUND PLAN OF NO. 354 WEST THIRTIETH STREET.



Ground plan of Cellar:
A. Cesspool, with pipe open. B. Cesspool, with pipe open. C. Stairs from Cellar to First Floor

XLVII. 431 West Forty-third, 1 death ; child, aged 4 years.

SIDE ELEVATION OF BASEMENT AND CELLAR OF NO. 431 WEST FORTY-THIRD STREET.



Side Elevation of Cellar of No. 431 West Forty-third street.

W. C. Water-Closet.

A. Trap to Water-Closet.

B. Open Joint.

C. Hole (1½ inch dia.) in Pipe, open.

"In this case we found an open joint at the point of junction of the water-closet trap with the iron sewer pipe, and a large hole in side of said pipe, from both of which were a free and very perceptible escape of foul sewer gas."

XLVIII. No. — East Fifty-first street, near Fourth avenue, 1 death; a young man aged 20 years. Nothing could be discovered wrong about the premises or in the house drainage. The patient, however, when questioned as to his habits and business, said he was employed as a carpenter, and had been for two weeks previous to his attack engaged in repairing the large ice-boxes used in butchers' shops for keeping their meats. He said he was obliged to go into these and remove the inside board lining which usually rotted out every year, and replace it with new. The stench emitted from these decayed boards and inside lining was so great, in almost every instance, as to compel him frequently to go out into the open air, and he sometimes vomited in consequence. At times some of these ice-boxes were so foul, that he could only work in them but a few moments at a time. He had not been well since he commenced this kind of work, having a constant distressing headache, and finally was taken with a chill, followed with the usual symptoms of Cerebro-Spinal Meningitis, of which he died.

The autopsy disclosed the whole surface of the brain congested, veins and sinuses having considerable fluid blood, the ventricles having considerable effused serum in them, and the meningeal vessels intensely congested. The congestion extending as far down the spinal canal as could be seen from the opened cranium, with effusion in the canal. All

the other internal viscera of the body were found in a normal condition. Further illustrations would but add to the corroborative evidences here presented.

In these examinations, and many others not given in the above list, when carefully made, (as they were in most instances, with the assistance of an experienced plumber attached to the Bureau, as Assistant Engineer), not only were sewer and drain pipes found disjointed and imperfectly connected in the various houses, but in some instances the old lead soil pipes were found so corroded by the sewer gas, as to present a honey-combed appearance, through whose interstices it constantly escaped, thereby befouling the atmosphere of the cellars and rooms above.

It may not be deemed out of place here to notice the fact, that in a very large proportion of the dwellings in this city, whether private houses, tenements, or "flats," adequate and proper provisions are rarely ever made for the ventilation or escape of sewer gas, which is constantly being generated in the sewer and soil pipes. Such a provision may be easily and simply provided, *by extending the main soil pipe with which all the waste pipes of the house connect, directly upwards and outwards beyond the roof of the house, from the street sewer, without any intervening stench trap.* By this simple and direct means, all the poisonous or offensive gases, generated in the street sewers, or soil pipes of the houses, would have an unobstructed outlet to the higher stratum of air, where they would become innocuous by rapid dilution. If, in addition, this soil pipe could be so arranged—as it might be in new buildings—so as to pass upwards, either into the chimney, or by a separate flue connected therewith, it would become heated by its proximity, and an additional impetus thereby afforded to the upward current, thus increasing its effect as a ventilating shaft both for the house drains and the public sewer connected with it. Such a construction has, in several instances, been recommended and applied, and is found to fulfill all that was anticipated in removing offensive odors from the dwellings, and purifying the atmosphere of the rooms.

PRACTICAL DEDUCTIONS :

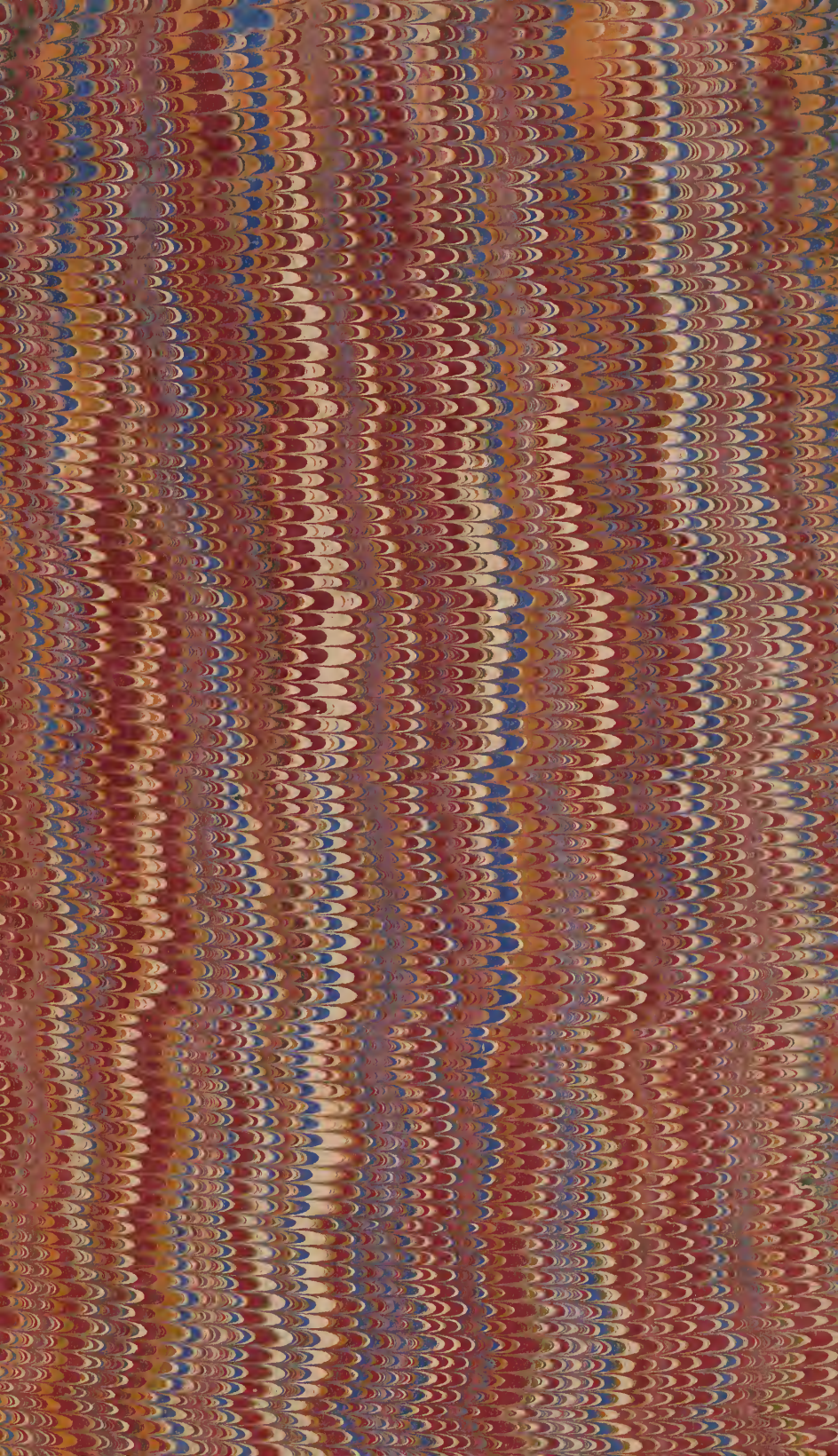
That this disease is specific in its nature, possessed of great fatality, having an analogous etiology with Typhoidal diseases, but depending upon the elimination of some special poison generated in the *decomposition* of animal and vegetable matter, under certain meteorological conditions.

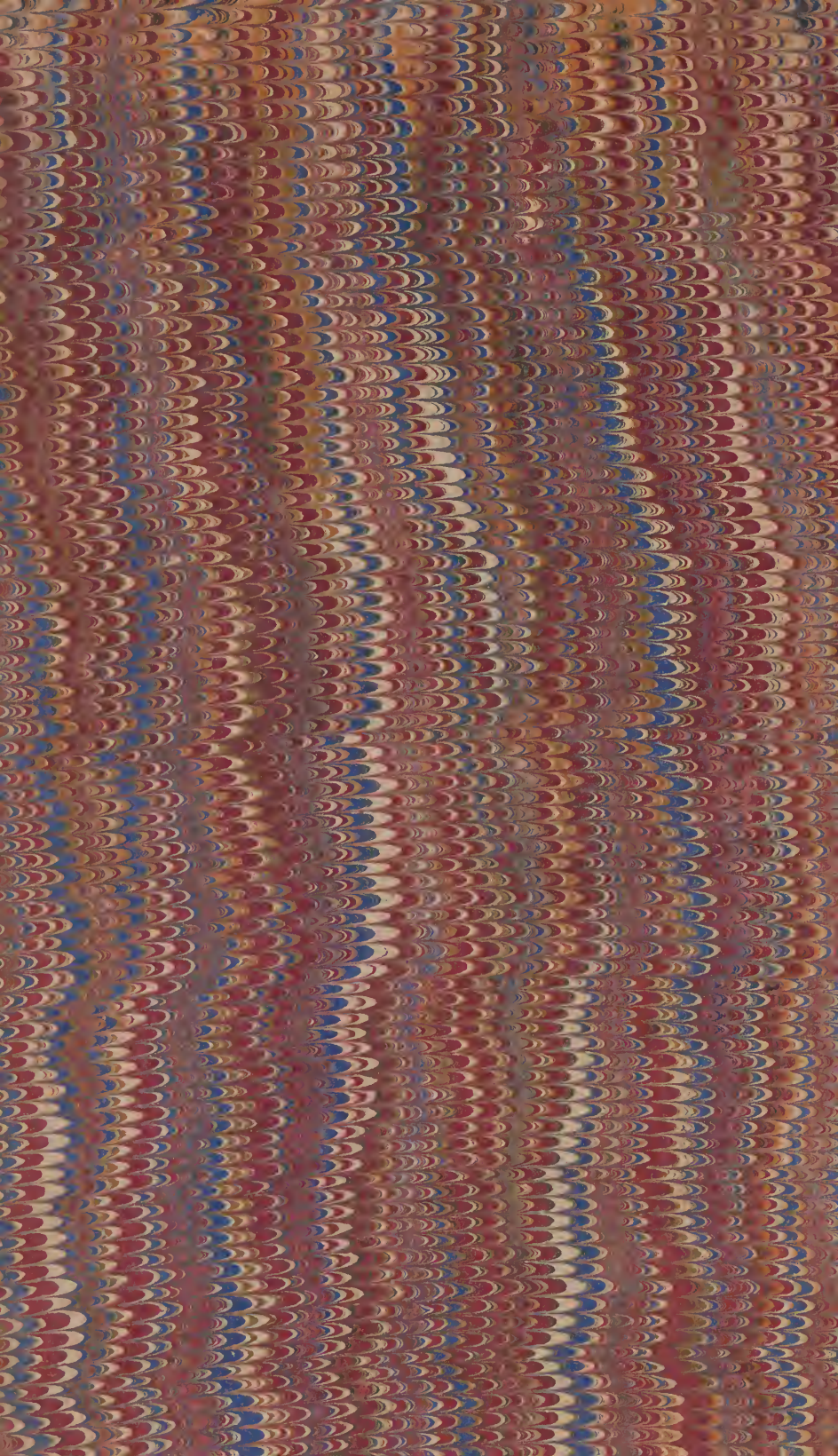
That it is not contagious or infectious from the person, or through the medium of fomites.

That its mode of attack is by the operation of this special poison upon the blood, through inhalation or possibly cutaneous absorption.

That its special lesions are congestion of the vessels of the brain and spinal axis, followed by the sequelæ of acute and sub-acute inflammation.

Its prophylaxes are the prevention of the escape of poisonous sewer gases into dwellings, by providing for their free outlet into the external atmosphere; thorough cleanliness and removal of all decomposing matter about the premises; disinfection with carbolic acid in some form or some other equally powerful arrester of decomposition; free ventilation of all close or confined places, by the admission of fresh air in large volumes; and thorough washing or flushing out of all drains or sewer pipes connected directly or remotely with dwelling houses.





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